Aerial IR Camera Project Proposal for Uinta Basin

BLM/UDAQ/Ute Tribe?/EPA

Outline

- Why conduct Aerial IR Survey in Uinta Basin
- O&G air emission research findings
- Precedence of Aerial IR Surveys in O&G
- Uinta Basin – work underway
- NEPA
- Next Steps
- Project proposal - details

Why conduct aerial IR survey in UB

- Air quality challenges in UB
- Emission discrepancy: top-down vs. bottom-up
- Inform emission inventory work underway and future mitigation options
  - O&G emission inventories do not accurately account for super-emitters
  - EI $\rightarrow$ ozone model $\rightarrow$ policy decisions on mitigation
- Super emitters a challenge to find
  - Not fixed in time or space
  - Function of operation & maintenance
  - Many such emission sources not covered by CAA currently, so no reporting
  - Not a function of size of facility – UB predominantly small sources
- Reduce VOC emissions by timely identification of malfunctions and fixing them

O&G air emission research findings

- Discrepancy between top-down measurements and bottom-up emission inventories
  - In UB, airborne measurements ~8.9% of gas produced to atmosphere compared to GHGRP-W ~ 1.0%
  - In UB, Ozone modeling shows low negative bias for VOCs and methane by factor of 1.8 and 4.8 respectively
  - Discrepancies found in many other basins – not unique to UB

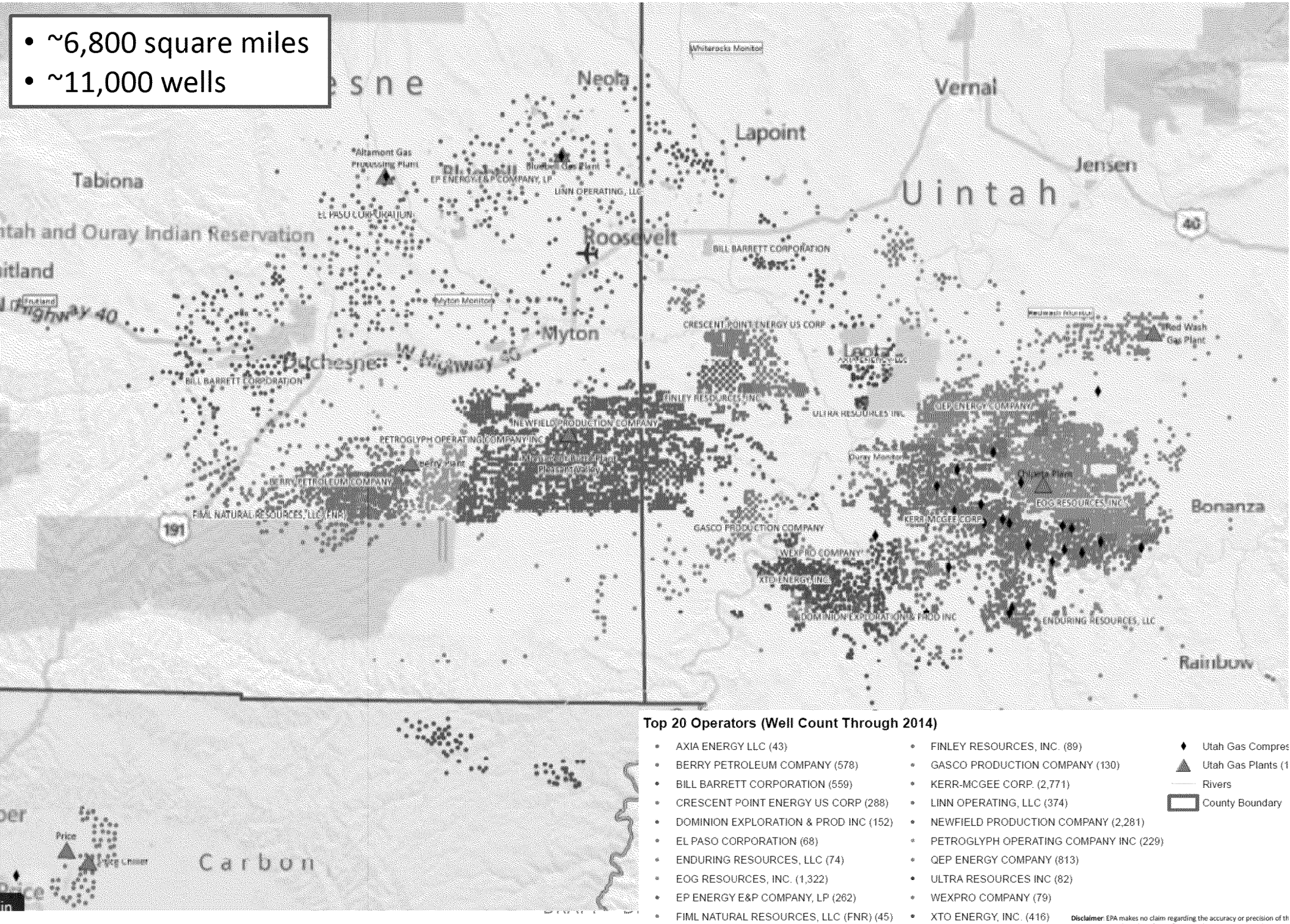
O&G air emission research findings, cont'd

- Skewed emission distributions, fat tail, "super-emitter" … a small % of sources account for a large % of emissions – **not fixed in time or space**
  - Wellpads – 86 natural gas wellsites … ~5% sites → ~60% of emissions
  - Wellpads-Compressor Stations-Gas Plants – Barnett Shale region … 2% sites → 50% of emissions and 10% sites → 90%
  - Midstream Compressor Stations – 114 CSs … 25 CSs vented >1% of gas processed, 4 CSs vented >10% gas processed
  - Midstream Compressor Stations – 114 CSs … 30% sites → ~80% of emissions
  - Gas Plants - 16 gas processing plants … 45% sites → ~80% of emissions
  - Transmission Compressor Stations – 45 CSs … 10% sites → ~ 50% of emissions
  - Abandoned Wells – 19 abandoned wells… 3 of the 19 wells had CH4 flow rates three orders of magnitude larger than the median flow rate
  - Well Liquid Unloading – 107 wells with liquid unloadings …
    w/o plunger lift: 20% wells → 83% of emissions
    w/ plunger lift and manual: 20% wells → 65% of emissions
    w/ plunger lift and automatic: 20% wells → 72% of emissions
  - Pneumatic Controllers – 377 controllers … 20% devices → 96% of emissions

Precedence of Aerial IR Surveys in O&G

- TCEQ - 16 campaigns since 2005
  - $200,000 for a 2 month campaign
  - $50,000-$75,000 for that smaller, earlier campaigns
- R6 - 5 campaigns in 2012-2013
- Both agencies concluded about 10% of facilities had continuous leaks, unintentional gas carry through, or unpermitted releases
- EDF Aerial IR Surveys of 7 basins
  - Ranged from 1% - 14% of facilities with observable emissions from air
  - 6.6% of sites in UB (1389 wellpads surveyed)
- LSI contractor - has conducted dozens of flyover campaigns for TCEQ, EPA Regions 6 & 4, Industry and researchers (EDF study) in many different basins across the U.S.

- ~6,800 square miles
- ~11,000 wells



Top 20 Operators (Well Count Through 2014)

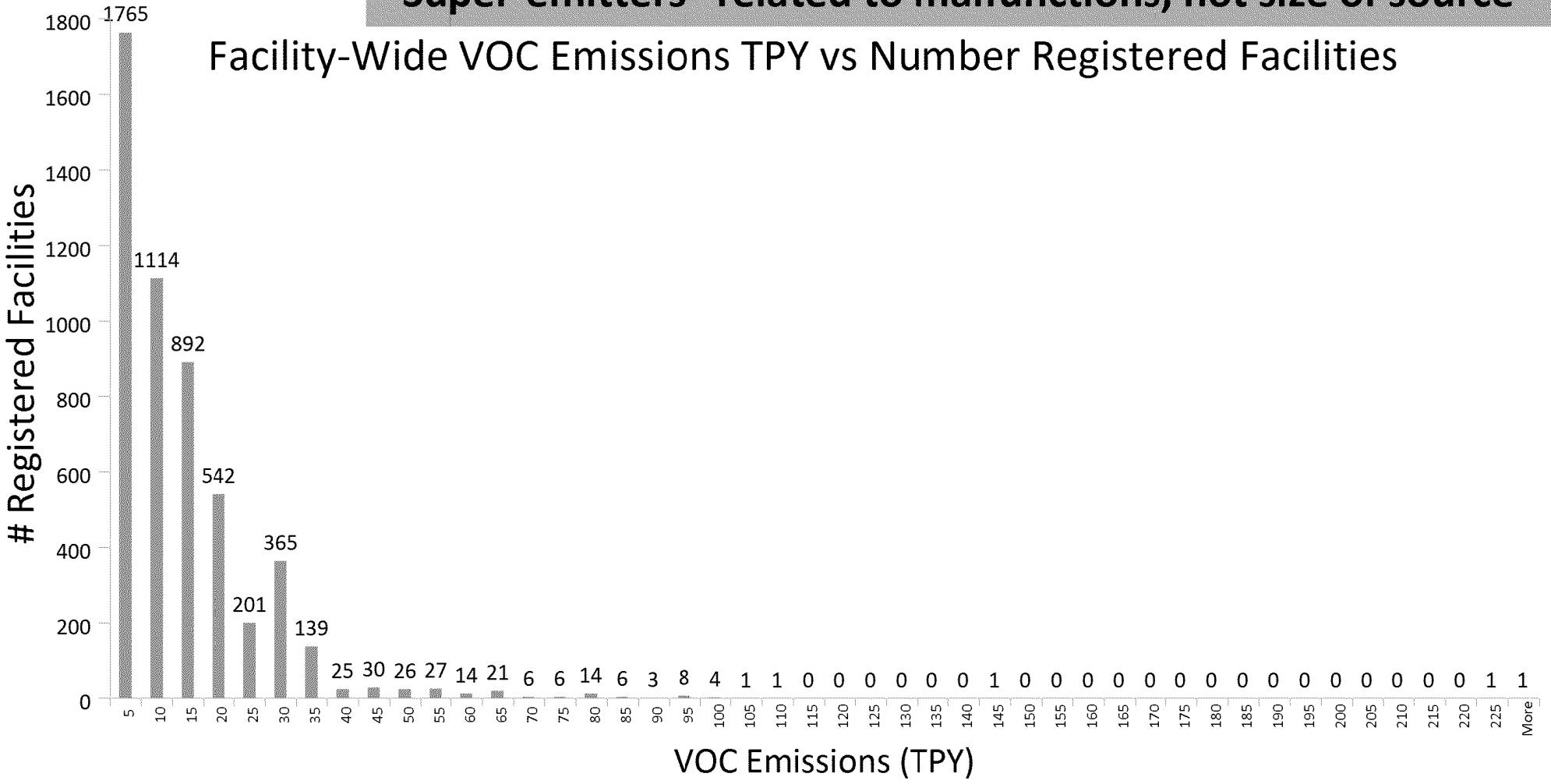
- AXIA ENERGY LLC (43)
- BERRY PETROLEUM COMPANY (578)
- BILL BARRETT CORPORATION (559)
- CRESCENT POINT ENERGY US CORP (288)
- DOMINION EXPLORATION & PROD INC (152)
- EL PASO CORPORATION (68)
- ENDURING RESOURCES, LLC (74)
- EOG RESOURCES, INC. (1,322)
- EP ENERGY E&P COMPANY, LP (262)
- FIML NATURAL RESOURCES, LLC (FNR) (45)
- FINLEY RESOURCES, INC. (89)
- GASCO PRODUCTION COMPANY (130)
- KERR-MCGEE CORP. (2,771)
- LINN OPERATING, LLC (374)
- NEWFIELD PRODUCTION COMPANY (2,281)
- PETROGLYPH OPERATING COMPANY INC (229)
- QEP ENERGY COMPANY (813)
- ULTRA RESOURCES INC (82)
- WEXPRO COMPANY (79)
- XTO ENERGY, INC. (416)

- Utah Gas Compres
- Utah Gas Plants (1
- Rivers
- County Boundary

U&O Tribal Minor Source Registrations

UB – Skewed with most facilities small emitters

"Super-emitters" related to malfunctions, not size of source



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Uinta Basin Work Underway

- UB Emission Inventory Workgroup – Phase I
  - EPA, Tribe, State and Operators
  - Preparing for eventual SIP demonstration
  - Phase I compiled into single database – analysis underway
  - VOC emissions ↓ compared to WRAP Ph. III
- UB Pneumatic Controller research project – summer/fall 2016
  - #1 methane emission source and #3 VOC emission source
  - Bottom-up emission measurements
  - Actuation counts on intermittent controllers
  - Method development

Uinta Basin Work Underway, cont'd

- Potential for U&O Reservation-specific FIP rulemaking for pre-NSPS OOOO sources
  - Level playing field with UDAQ sources - Includes LDAR as ground-based with OGI

- Region 8 NEPA evaluations
  - 5 Completed EIS/EA RODs include triggers and requirements for "Enhanced DI&M", but not-yet defined

  - EPA is currently a cooperating agency with BLM for EIS development for three projects to add thousands of O&G wells to UB – discussing mitigation options on existing sources
    - NEPA Team requested a proposed protocol for "Enhanced DI&M" – provided ground-based OGI option
    - Operators pushing back, requiring specific reductions on existing facilities"

NEPA – How Aerial IR Survey could fit

- Component of the BLM's Basin-wide Ozone Action Plan outlined in previous NEPA documents
- Component of the "enhanced mitigation" required in Adaptive Management Strategy triggered by ozone exceedances in 5 already-approved EISs/EAs
- As a component of ozone mitigation in the new NEPA actions under review
- Operators reduce emissions from existing sources through a "Find & Fix" approach and share lessons learned on root causes of super-emitters
- Informs emission inventory work – currently no accounting for super-emitters in Uinta Basin emission inventory
- Learn about root causes of super-emitters to prevent in future through maintenance practices

Benefits to NEPA project proponents

- Discrete, cost-effective project
- Detection costs borne by regulators
- Supports ROD commitments to enhanced mitigation and supports need to avoid adverse ozone impacts in NEPA projects currently awaiting approval to show reductions in existing emissions
- "Find & Fix" versus enforcement (*fix before winter ozone season*)
- Inform emission inventory work for more complete emission inventory which will inform cost-effective emission mitigation options for SIP
- Learn about root causes of super-emitters to prevent in future through maintenance practices
- Conserve gas → more to market

Cost & Schedule

- Occur in 2016 before winter and potential reservation-specific FIP or BLM Waste Prevention (F&V) regs

- Fly-over with IR camera survey
  - 15 days, 29 "grids", **$105k**
  - Cover ~4800 sites (~44% of oil & gas wells)
  - Representative by Operator, age, production volume, well type (incl. abandoned)
  - Cover >50% of compressor stations and gas plants

- Ground-based IR camera survey
  - 24 days, 1 "grid", $26k
  - Cover ~165 sites
  - For same coverage as fly-over: ~700 days, **$760k**

Cost Share

Current Plan – Regulators pay to "find"

HELICOPTER-IR CAMERA FLYOVER of the UINTA BASIN

Enhanced Inspection & Maintenance Project for NEPA Project Proponents

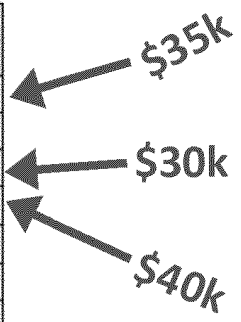
	Within Exterior Boundaries U&O Current Operator	Number of Wells (2014)	OIL Produced Barrels (2014)	GAS Produced Mcf (2014)	Prorata Cost Average $k
ROD - Adaptive Mgmt Stragety	KERR-MCGEE CORP.	2706	1,042,197	203,382,460	44.5
	XTO ENERGY, INC.	416	97,486	10,740,094	4.0
	GASCO PRODUCTION COMPANY	123	74,545	6,759,713	1.8
	KOCH	18	3,436	422,013	0.2
Project Under Review	NEWFIELD PRODUCTION COMPANY	1409	7,043,408	11,888,643	30.6
	EOG RESOURCES, INC.	1319	655,458	35,547,477	14.0
	CRESCENT POINT ENERGY US CORP	240	2,752,210	2,854,439	10.0
	SUB-TOTAL	6231	11,668,740	271,594,839	
	% of Universe	**65%**	**40%**	**75%**	

105	**$k Cost to Operator of Flyover [15 days, 29 grids, ~4800 sites]**

	Within Exterior Boundaries U&O Current Operator	% of Universe OIL Prod (2014)	% of Universe GAS Prod (2014)
ROD - Adaptive Mgmt Stragety	KERR-MCGEE CORP.	4%	56%
	XTO ENERGY, INC.	0.3%	3%
	GASCO PRODUCTION COMPANY	0.3%	2%
	KOCH	0.01%	0.1%
Project Under Review	NEWFIELD PRODUCTION COMPANY	24%	3%
	EOG RESOURCES, INC.	2%	10%
	CRESCENT POINT ENERGY US CORP	9%	1%

Input
Result

Funding Partners	$k Contribution
EPA	0
Ute Tribe	0
UDAQ	0
BLM	0
County	0
Other	0
Operator	105
TOTAL =	**105**



Next Steps

- Outline potential mechanisms for implementation
- BLM/UDAQ/Tribe?/EPA jointly develop a deliberate communication strategy to roll out proposal to Tribe, Operators …
- BLM/UDAQ/EPA agree on scope, reporting needs, etc.…

Project Proposal - Details

Project Purpose

- Through a collaborative effort of the BLM, EPA, Utah, Ute Tribe, and Operators:
  - Find large releases of hydrocarbon emissions from O&G operations in an efficient and cost effective manner
  - Identify cause of releases
  - Fix releases to reduce emissions and conserve gas prior to winter ozone season

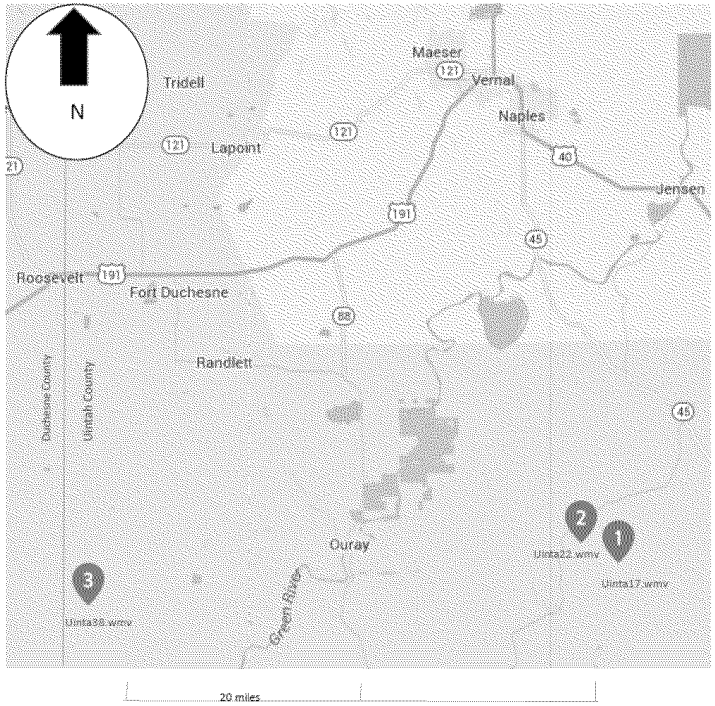
- Inform emission inventory work on the frequency/probability of super-emitters

- Inform policy on mitigation options from characterization of super-emitters

General Approach

- Contract Leak Surveys Inc. (LSI)
- Conduct a series of aerial infrared (IR) surveys via helicopter
- Count facilities flown over
- Log data of observed emissions
- Analyze data and videos, differentiate routine/allowable vs. malfunction, and rank based on severity of emissions
- Contact operators with log of observed emissions
- Allow operators to respond, determine cause, fix, and report cause and repair

Example Video from EDF Aerial IR Survey in UB – Allowable vs. malfunction



uintah17.wmv tank vent at wellpad (looks like a stuck open dump valve)

uintah22.wmv dehydrator still vent at wellpad (allowable venting)

uintah38.wmv separator pressure relief valve (malfunctioning PRV)

Contractor

- Leak Surveys Inc. (LSI)
  - Based in TX
  - Have conducted dozens of flyover campaigns for TCEQ, EPA Region 6 & 4, Industry, and researchers in many different basins

http://www.leaksurveysinc.com

Grid Development

- "Grids" are sections of land designated to be flown over
- 29 grids created - 15 square miles each
- 2 grids per day
- Distance from airports
  - 35 miles maximum
  - Roosevelt Municipal Airport
  - Vernal Regional Airport
- 4,791 active, producing wells in grids (avg. 165 wells/grid) … ~44% of universe

Airports

- Public and attended
  - Helicopter fuel for purchase
- Roosevelt Municipal
  - Centrally located
- Vernal
  - Further east
  - Assists in reaching grids with high gas production

What's covered

- Representativeness of the grids compared to the U&O as a whole verified with well counts by:
  - Well type– oil, gas, abandoned/shut-in
  - Age of well
  - Production
  - Operator

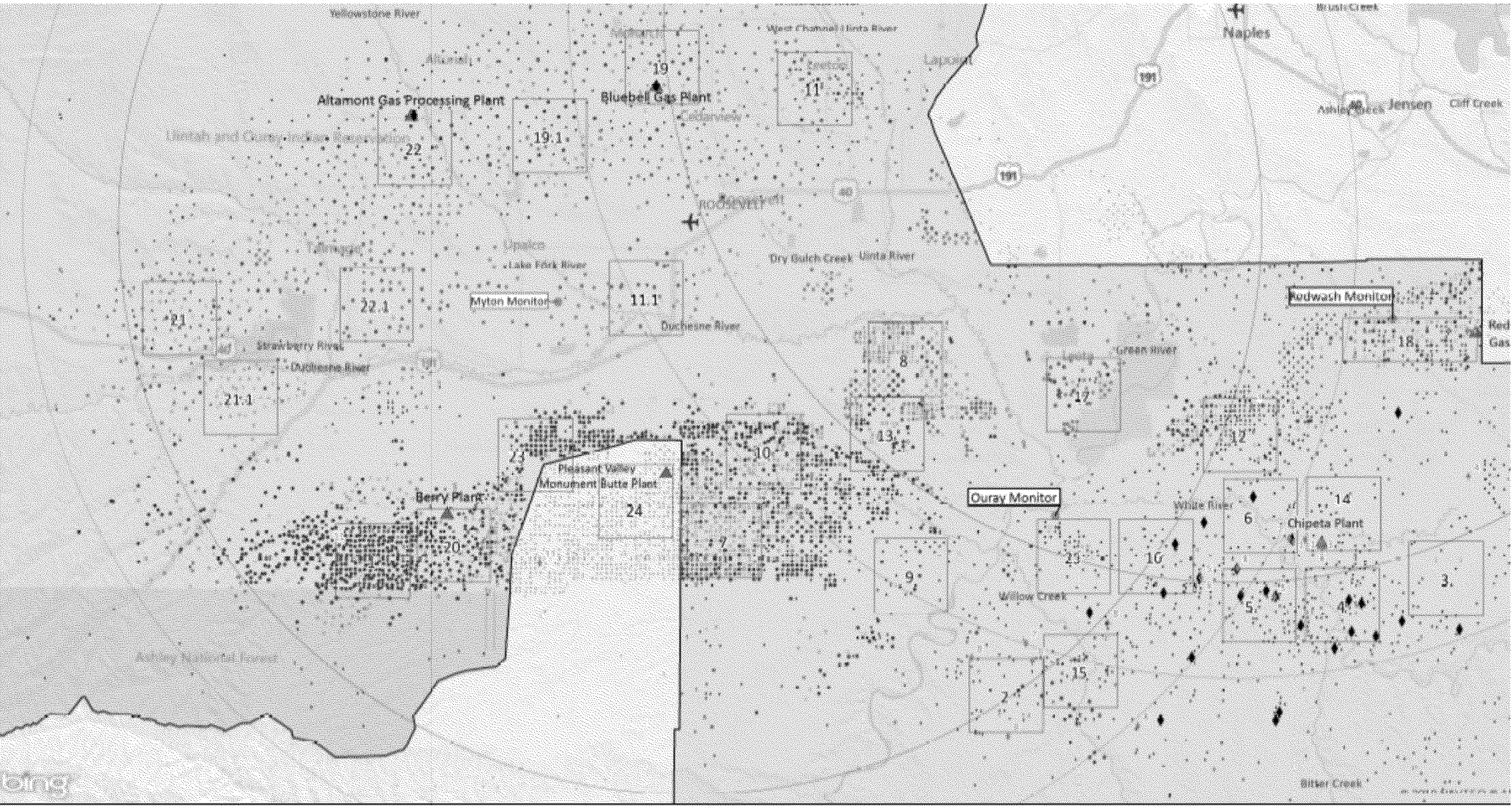
- Also flyover Process Facilities– compressor stations, gas plants

Well - Production Type

Well Count: Fly-over					**Well Count: Universe**		
Type	Count	% of Flyover			Type	Count	% of Universe
Active Oil Well	1614	33.7%			Active Oil Well	4009	41.5%
Active Gas Well	3168	66.1%			Active Gas Well	5626	58.2%
Active O&G Well	9	0.2%			Active O&G Well	27	0.3%
Total Active	4791	100%			Total Active In U&O	9662	100%
P&A/SI	773				P&A/SI in U&O	2748	

Well - Age and Production

Active Producing Wells: Fly-over					Active Producing Wells: Universe		
Age	Count	% of Flyover			Age	Count	% of Universe
2013-2015	791	16.5%			2013-2015	1536	15.9%
2010-2012	1280	26.7%			2010-2012	2162	22.4%
2000-2009	2029	42.4%			2000-2009	4479	46.4%
1990-1999	411	8.6%			1990-1999	775	8.0%
<1990	254	5.3%			<1990	637	6.6%
Total	4765	99.5%			Total	9589	99.2%
2014 Oil Production Volume (bbls)	Count	% of Flyover			Oil Production Volume (2014 bbls)	Count	% of Universe
≤2500	3552	74.1%			≤2500	7032	72.8%
2501-5000	436	9.1%			2501-5000	837	8.7%
5001-10000	338	7.1%			5001-10000	743	7.7%
10001-30000	233	4.9%			10001-30000	573	5.9%
30001-218075	69	1.4%			30001-218075	159	1.6%
Total	4628	96.6%			Total	9344	96.7%
Gas Production Volume (2014 MMcf)	Count	% of Flyover			Gas Production Volume (2014 MMcf)	Count	% of Universe
≤25	2565	53.5%			≤25	5488	56.8%
25.001-75	1200	25.0%			25.001-75	2568	26.6%
75.001-125	434	9.1%			75.001-125	706	7.3%
125.001-175	185	3.9%			125.001-175	261	2.7%
>175.001	244	5.1%			>175.001	321	3.3%
Total	4628	96.6%			Total	9344	96.7%



Uintah Ouray Reservation Oil Production

Production in Bbls for Active Producing Oil Wells in 2014 (Well Count)

- 0 - 2,500 (1,620)
- 2,501 - 5,000 (757)
- 5,001 - 10,000 (714)
- 10,001 - 30,000 (567)
- 30,001 - 218,075 (159)
- Part 71 Permits (20)
- Gas Plants (7)
- Gas Compressor Stations (28)
- NA in Production 2014 (213)
- Abandoned, Shut-in Wells (2,395)
- Air Monitors
- Rivers
- 35 Mile Range
- 30 Mile Range
- Grids
- Reservation Boundary

*These well counts represent 3817 of 4036 (94.69%) Active & Producing Oil wells inside the Reservation. This includes the NA in Production, as they were classified as Active & Producing.

EPA Part 71 Permitted Facilites, Operators

Operator	10 In Map	Closest	Reservation Total
QEP Field Services Company	5	5	5
Questar Pipeline Company	5	1	5
Anadarko Petroleum Corporation	5	3	3
Deseret Generation and Transmission Co-Operative	4	1	1
Anadarko Uintah Midstream, LLC	3	3	3
Wind River Resources Corporation	3	--	3
CRIMM Refining, LLC	3	3	3
KFD Energy, Inc	6	5	5
Whiting Petroleum Company	5	--	5
Monarch Natural Gas, LLC	10	--	5
Berry Petroleum Company	11	2	2
		20	23

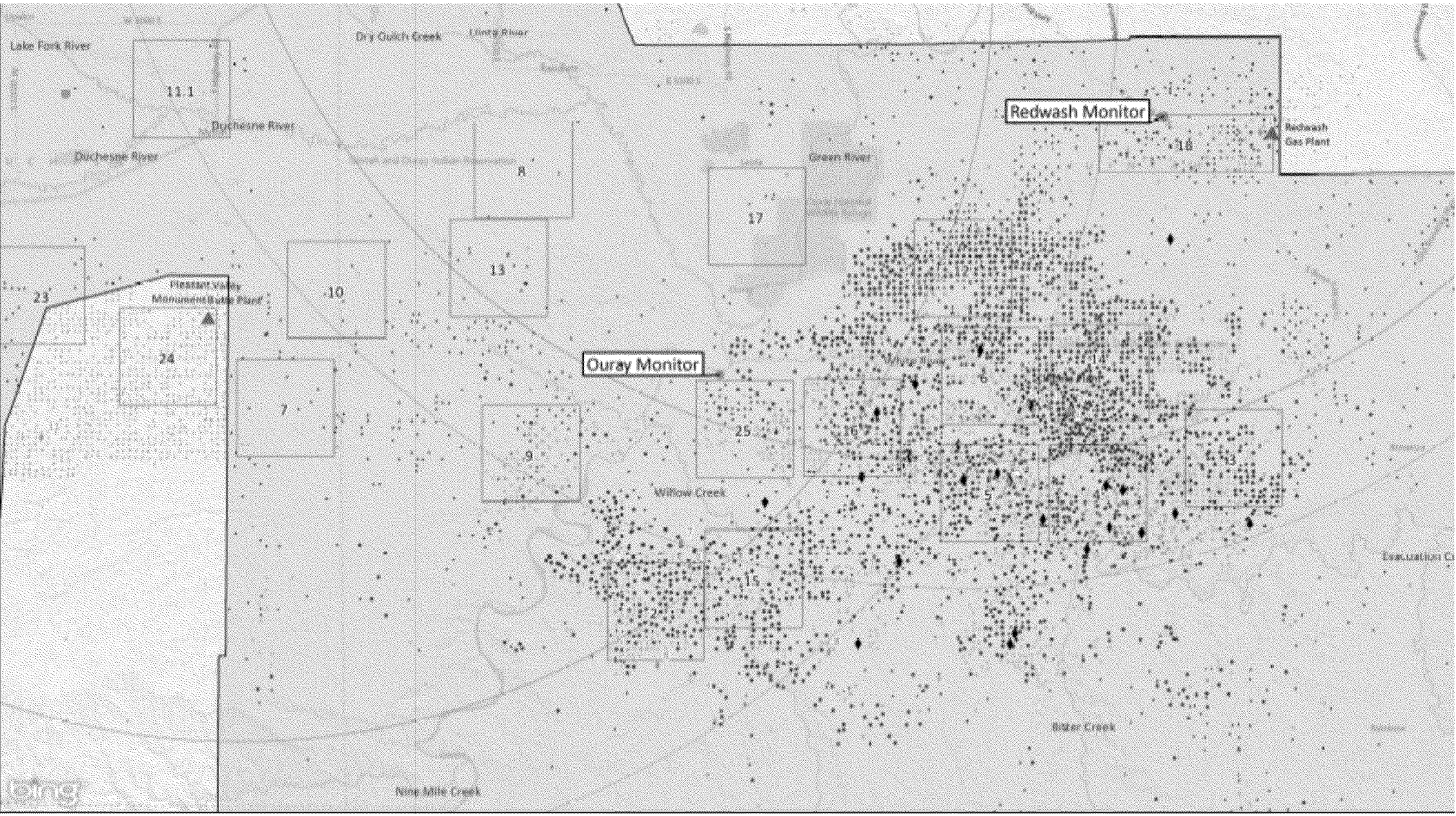
Date: August 3, 2015

Map Projection: UTM, Meters, Zone 12N, NAD 83

Data Sources:

Air Monitoring Stations - Air Quality System, AQS (2013);
Oil and Gas Wells - Drilling Info (2015);
Tribal Boundary - US Census Bureau (2009);
Airports - FAA (2013).
Gas Plants - EPA (2013).
Compressor Stations - NGA (2013).
Rivers - NHDPlus (2012).
Basemap - Microsoft Bing Webservice (2015).

0 5 10 Miles
0 5 10 Kilometers



Uintah Ouray Reservation Gas Production

Production in MMcf for Active Producing Gas Wells in 2014 (Well Count)

- 0 - 25 (2,249)
- 25.001 - 75 (1,983)
- 75.001 - 125 (607)
- 125.001 - 175 (227)
- 175.001 - 1,890 (275)
- Part 71 Permits (19)
- Gas Plants (DI) (4)
- Gas Compressor Stations (DI) (26)
- N/A in Production 2014 (87)
- Abandoned, Shut-In Wells (1,756)
- Air Monitors
- Rivers
- 35 Mile Range
- 30 Mile Range
- Grids
- Reservation Boundary

*These well counts represent 5427 of 5626 (96.46%) Active & Producing Gas wells inside the Reservation. This includes the NA in Production, as they were classified as Active & Producing.

EPA Part 71Permitted Facilities, Operators

Operator	ID in Map	Count	Reservation Total
QEP Field Services Company	7	3	3
Questar Pipeline Company	2	1	1
Anadarko Petroleum Corporation	3	2	2
Deseret Generation and Transmission Co-Operative	4	1	1
Anadarko Uintah Midstream, LLC	5	3	3
Wind River Resources Corporation	6	-	1
Ute Tar Gathering, LLC	7	1	1
XTO Energy, Inc	8	5	5
Whiting Petroleum Company	9	-	1
Monarch Natural Gas, LLC	10	-	1
Berry Petroleum Company	11	1	1
		15	23

Date: August 3, 2015

Map Projection: UTM, Meters, Zone 12N, NAD 83

0 5 0 5 10 Kilo

Data Sources:

Air Monitoring Stations - Air Quality System, AQS (2013);
Oil and Gas Wells - Drilling Info (2015);
Tribal Boundary - US Census Bureau (2009);
Airports - FAA (2013).
Gas Plants - EPA (2013).
Compressor Stations - NGA (2013).
Rivers - NHDPlus (2012).
Basemap - Microsoft Bing Webservice (2015).

Disclaimer: EPA makes no claim regarding the accuracy or precision of concerning the data should be referred to the source agency. This m represent EPA's position on any Indian Country boundaries or the any specific location.

Well - Operator

Operators: Fly-over					Operators: Universe		
Operator Name	Count	% of Flyover			Operator Name	Count	% of Universe
AXIA ENERGY LLC	38	0.8%			AXIA ENERGY LLC	43	0.4%
BERRY PETROLEUM COMPANY	150	3.1%			BERRY PETROLEUM COMPANY	578	6.0%
BILL BARRETT CORPORATION	89	1.9%			BILL BARRETT CORPORATION	284	2.9%
CANNON, ROBERT	1	0.0%			CANNON, ROBERT	1	0.0%
CNG PRODUCING COMPANY	3	0.1%			CNG PRODUCING COMPANY	4	0.0%
COASTAL OIL & GAS CORP.	5	0.1%			COASTAL OIL & GAS CORP.	9	0.1%
CRESCENT POINT ENERGY US CORP	118	2.5%			CRESCENT POINT ENERGY US CORP	240	2.5%
DOMINION EXPLORATION & PROD INC	59	1.2%			DOMINION EXPLORATION & PROD INC	152	1.6%
EL PASO CORPORATION	18	0.4%			EL PASO CORPORATION	68	0.7%
ENDURING RESOURCES, LLC	14	0.3%			ENDURING RESOURCES, LLC	74	0.8%
EOG RESOURCES, INC.	787	16.4%			EOG RESOURCES, INC.	1319	13.7%
EP ENERGY E&P COMPANY, LP	91	1.9%			EP ENERGY E&P COMPANY, LP	261	2.7%
FIML NATURAL RESOURCES, LLC (FNR)	20	0.4%			FIML NATURAL RESOURCES, LLC (FNR)	45	0.5%
FINLEY RESOURCES, INC.	67	1.4%			FINLEY RESOURCES, INC.	85	0.9%
GASCO PRODUCTION COMPANY	70	1.5%			GASCO PRODUCTION COMPANY	123	1.3%
HARVEST (US) HOLDINGS, INC	3	0.1%			HARVEST (US) HOLDINGS, INC	8	0.1%
INLAND PRODUCTION COMPANY	1	0.0%			INLAND PRODUCTION COMPANY	1	0.0%
KERR-MCGEE CORP.	1488	31.1%			KERR-MCGEE CORP.	2706	28.0%
KOCH EXPLORATION COMPANY, LLC	12	0.3%			KOCH EXPLORATION COMPANY, LLC	18	0.2%
LINN OPERATING, LLC	163	3.4%			LINN OPERATING, LLC	374	3.9%
NEWFIELD PRODUCTION COMPANY	852	17.8%			NEWFIELD PRODUCTION COMPANY	1409	14.6%
PETROGLYPH OPERATING COMPANY INC	108	2.3%			PETROGLYPH OPERATING COMPANY INC	229	2.4%
QEP ENERGY COMPANY	309	6.4%			QEP ENERGY COMPANY	793	8.2%
QUINEX ENERGY CORP	8	0.2%			QUINEX ENERGY CORP	17	0.2%
UINTA-TAYLOR FUND, LTD	1	0.0%			UINTA-TAYLOR FUND, LTD	1	0.0%
ULTRA RESOURCES INC	77	1.6%			ULTRA RESOURCES INC	82	0.8%
WEXPRO COMPANY	11	0.2%			WEXPRO COMPANY	64	0.7%
XTO ENERGY, INC.	228	4.8%			XTO ENERGY, INC.	416	4.3%
Total	4791	100%			Total	9404	97.3%

Process Facilities

- No production values for compressor stations, gas plants, or EPA permitted facilities

Process Facilities Count: Fly-over				**Process Facilities Count: Universe**	
Type	Count			Type	Count
Compressor Stations	16			Compressor Stations	28
Gas Plants	7			Gas Plants	7
EPA Permitted	8			EPA Permitted	23

Cost for Aerial IR Survey

		input values
		total cost of campaign
Number of grids to flyover	29	
Time flying to grid from airport (hr)	0.5	half hour
Time flying from grid to airport (hr)	0.5	half hour
Time surveying each grid (hr)	1.5	hour and a half
Hours flying to and from Texas (mobilization hours) (hrs)	24	
Cost per hour of flying to and from Texas (mobilization)($/hr)	$ 600	
Cost of mobilization ($)	$ 14,400	Cost per hour*hours of flying
Cost per hour of flying (accounts for all costs except fuel)($/hour)	$ 1,100	Includes lodge, per diem, and crew
Cost of helicopter fuel ($/gallon)	$ 5.50	
Fuel economy (gallons/hr)	15	
Number of standby days (days)	3	1 standby day a week
Cost per standby day ($/day)	$ 1,500	
Total number of hours to fly all grids (hr)	72.5	sum of hours per grid * number of grids
Cost of flying ($)	$ 79,750	Cost per hour of flying * Total number of hours to fly all grids
Cost of fuel for campaign ($)	$ 5,981	Cost of fuel*Fuel economy*Number of hours flying
Cost of standby days ($)	$ 4,500	Cost per day of standby * number of standby days
Total cost for campaign ($)	**$ 104,631**	

Cost Comparison – Ground vs. Aerial

Comparison in Cost of Fly-Over to Ground Based DI&M		
		input value
		total cost
Number of sites inspected	165	
Grid size (square miles)	15	
Ground Based Survey:		
Mobilization/demobilization ($)	$ -	
Number of crew members	2	
Man hour cost ($/hour) (direct + indirect)	70	
Amount of time per site (hours)	1	
Time inspecting (hrs)	165	
Miles driven	500	
Speed of truck (mph)	20	
Cost of gas ($/gallon)	2.79	
Hours of drive time	25	
Fuel Efficiency (miles per gallon)	15	
Total Man Hours (hrs)	380	
Days	24	vs. ~half a day/grid for flyover
Total Cost ($)	**$ 26,722**	vs. ~$3,600/grid for flyover

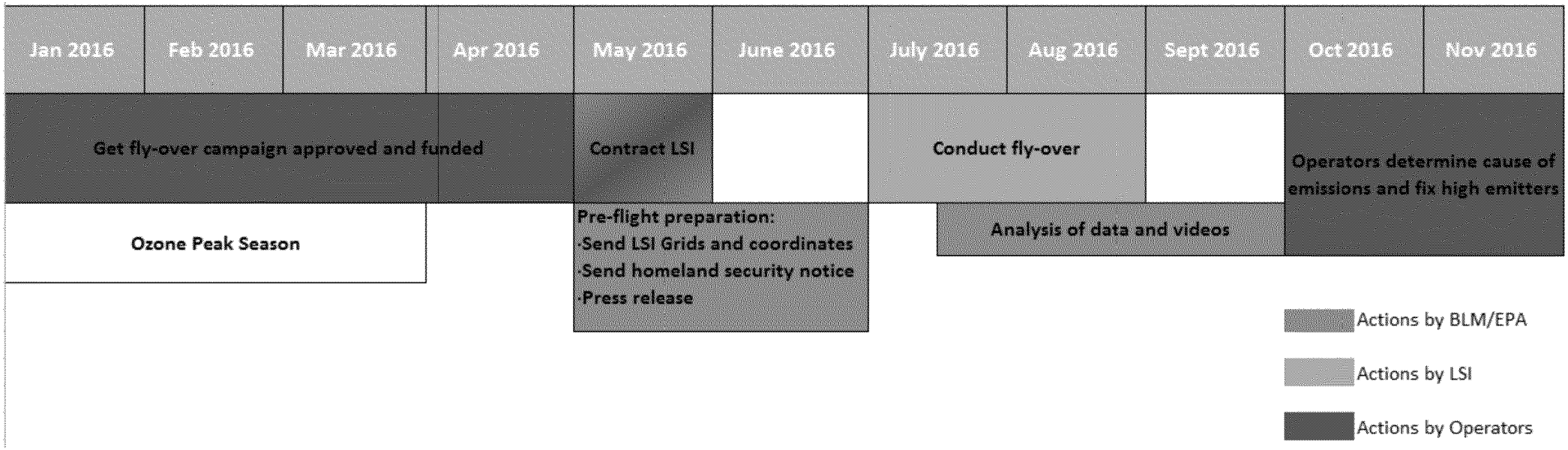
Fly-over Cost:

- ~$ 105,000/29 grids = **$3,621/grid**

- Mob/demob costs fixed, so $/grid would increase if fewer # of grids in campaign

Schedule

Needs to be updated ….



Survey Protocol

- Only LSI employees will be allowed in helicopter
  - Weight constraints
- Keep a count of number of facilities flown over
- At an observed hydrocarbon release:
  - Circle the emission source and facility 360°
  - Record IR video of releases for ≥ 90 seconds to differentiate intermittent (e.g. flash emissions from dump event) from unintentional gas carry-through
  - Take digital photos – overall facility and emission source
  - Record all required data for log
- In the event of an emergency emission the helicopter is to land and report it to BLM immediately

Data to Note in Log

- Date and time of recording
- Latitude/Longitude of the facility
- IR video - frame #s
- Digital pictures– entire facility and emission source - frame #s
- Equipment inventory of facilities circled
- Source of emission (e.g. tank, combustor, etc.)
- Additional observations made by surveyor
  - Notable severity of emission
- **Number of facilities flown over**

Flight Operations

- Any operation inquiries or decisions will be handled by LSI
- As shown in the overall timeline - 2 months allotted to LSI to conduct the surveys
  - LSI is a private contractor and may have other commitments.
  - Provides flexibility for this campaign
- The flight patterns must be ~30 minutes from an airport

Inclement Weather

- IR camera must be able detect emissions adequately
- Rain
- High wind speeds
- Cloudy days are at the discretion of the contractor
- Standby days cost $1,500 per day but won't exceed the amount of days per contract
  - Contract has 15 days (~72.5 hours of fly time) so there can only be up to 15 standby days
  - Have included 3 stand-by days in campaign cost estimate